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SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE
OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION
FOR THE ADVANCEMENT OF SCIENCE.

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FRIDAY, OCTOBER 3, 1902.

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

THE CARNEGIE INSTITUTION.

THE situation that confronts the Carnegie Institution seems to me this: We do not desire a break with the historical development; the energies which have brought about the rise of American scholarship to the present level must work toward its further advance. We are bound to the special conditions and limits of those energies if we do not wish to lose their benefits. Their characteristics, it seems to me, are determined by two factors, utterly unknown, for instance, in Germany. First, the supporting activity in the periphery of the national circle as over against the German governmental support. In Germany the aid came in centrifugal paths, in America in centripetal ones. Secondly, the order of the five hundred higher educational institutions in a sliding scale as over against the sharp demarcation lines of German schools and universities. These two factors belong of course together; both were necessary under the conditions of American history, and their influence must not be impaired, but rather turned to use in planning new progress.

For our concrete question the first factor, the activity in the periphery, seems to me to work in a negative way, as a limitation on all those plans which suggest themselves at the first glance. Everywhere we see departments, laboratories, whole institutions,

in need, scholars complaining that their means for work and research and publication are inadequate, students sighing for fellowships: happy the day when some hundred thousand dollars more every year appear on the horizon. And yet that happiness is a delusion; the loss would be greater than the gain: the help from the inside would stop not the willingness to help, but the willingness to make a strong effort to help on the outside, and just this strong effort in the local groups not only sums up in the long run to a much greater result than any single central aid, but it is also more wholesome, more educative, more adjustable, more American.

I do not speak as a spectator; I feel the want deeply myself. As chairman of the Harvard Philosophical Department I know our desire for the two hundred thousand dollars for Emerson Hall, the corner stone of which we wish to lay next May on the hundredth anniversary of Emerson's birth; we have only sixty thousand at present; how grateful should I be for a Carnegie check of a hundred thousand! As director of the Harvard Psychological Laboratory I should like to have an appropriation of ten thousand every year and should feel sure that, spent for apparatus and equipment for psychological research which I am anxious to make, not a cent of it would go for superfluous luxuries. As editor of the Harvard Psychological Studies I should need just one thousand dollars a year to print the material we gather, of which so much has been lost from lack of funds for publication. I need, thus, the large and the small sums like any one else, and if it be decided that the institution shall take up such patchwork I shall of course look out for my share of the spoil: but if I had to make the decision, I should ignore my small and my large needs and should prefer to go on with my suffering in the higher in-

terest of the scholarly life of the whole country. The institution might build our Emerson Hall, but that would not only take away the pride of all lovers of Emerson in having done their duty, but it would frustrate the hopes of all my colleagues in Harvard who need new buildings or libraries or laboratories or collections for their departments and who would hear in future everywhere the stereotyped answer: why do you not ask the Carnegie Institution? We want to stimulate the trustees, the alumni, the local friends, to build up their institutions by their generosity, by their enthusiasm, by their sacrifice; just such friendly rivalry has built up the intellectual life of the land. Every cent from Washington which disburdened the local officials is an opiate for this feeling of responsibility. It would be the gain of the moment and the ruin for the strongest factor of progress in the long run. The alumni would simply turn to other fields. We know how the aids for the church have slowly decreased and those for scholarship increased; just such a diversion from scholarship would take place, to other good things perhaps, but when we discuss the progress of scholarship we must ignore the fact that other good things stand waiting. And the trustees would imitate the alumni; to-day they scratch their funds together to find some hundreds for a new instrument or for printing expenses; to-morrow when the researchers are considered as provided for from Washington, all ready cash of the college treasurer will flow back again to the undergraduate needs and the higher work will soon be worse off than before.

The only centrifugal help which could be given without harm for the whole system is to be sought in such an arrangement as would aid not special individuals or institutions but the totality of scientific workers. A large printing establishment which un-

dertakes work on a commercial basis but without profit and with a yearly subvention of one or two hundred thousand dollars would bring down the costs of publication to the moderate expenses usual in Germany. If no text-books, but merely monographs, were printed there, an immense gain for the productive scholarship of the whole country might be expected. Large prizes for the solution of certain problems might be another, probably less helpful, scheme which would stimulate all alike without undertaking to support special institutions.

But, as I said, the life in the periphery works essentially as inhibition for central activity; it is the second characteristic feature, the system of smallest differences, the sliding scale of the institutions, which offers positive chances. In Germany where definite types are separated by sharp lines no new development is probable; in America, where the strength has always lain in the possibility of steady progress to higher and higher forms, the same energies must lead beyond the present state. Just as the principle of the sliding scale allowed the graduate school of to-day to grow out of the college of yesterday, we may expect that a higher form, an overgraduate school of tomorrow, will grow from the forms of to-day. And here is the place where the Carnegie Institution might hasten progress. Not a national university which should be in competition with the existing universities, but a higher type standing above all universities, and which, just like the graduate schools twenty years ago, might begin very modestly but might grow in some decades to a great national institution.

The students, or better, fellows, of this school would be young men beyond the doctor examination, young college instructors, men who wish to live some time in the atmosphere of pure research. The teachers would be the masters of the craft, the lead-

ing scholars of the country, men of undisputed energy and of original thought. The beginning might be small indeed: all our universities would be greater if half of the professors were left out. In our overuniversity a few great men without any doubtful second class would do, say, fifteen men with a salary of ten thousand dollars each. They would have to come all either for life or for one year; if the one-year system were chosen, they would remain in their own universities and go to Washington on leave of absence. Of course the establishment of such a highest honor in the profession would make necessary some measure of self-government, and herein the institution might become a model for the universities in which the autoratism of the trustees is clearly a relic of the college period but quite unsuited to a university. The German system is much more democratic; scholars choose the scholars, and this autonomic feature belongs to the research-making character of the German institution. The faculty chooses three, of whom the government elects one. In a similar way for instance the physics professors of the thirty largest institutions might propose a candidate for the physics chair, and the trustees of the institution be bound to appoint one of the three who received the three largest votes. There might be fifty fellowships of one thousand dollars to be distributed by the universities.

All this would demand two hundred thousand dollars, and the same sum for laboratory equipments after spending the whole income of the first year for a building. But while of course first-class research laboratories in physics, chemistry, biology, psychology, are essential, I venture even here in the columns of *SCIENCE* the heresy that the scientific experimental work of such highest institution would not be so important as the synthetic thought which is the one need in our age of scattered specialized

activities. The great problems of principle in all departments of knowledge, not only in natural science, need their temple. The method of the most intimate seminary where in the discussion with mature scholars the thoughts of the leaders develop themselves, would be still more important there than the laboratory method.

The honor of such a supreme court as the highest goal of a scholar would add essentially to the dignity and attractiveness of the academic career. As I said in my 'American Traits,' there are three ways to gain first-class men for productive scholarship, first, advancement in the academic career must be made entirely dependent upon printed achievement; secondly, the beginner must have a chance to remain in the atmosphere of real universities instead of being obliged to go as teacher to inferior colleges, and thirdly, the career must be made more attractive by great social premiums. My words have been sometimes misconstrued to mean only that a scholar would be a better scholar if he had more of the luxuries of life. Even that I believe to be true within certain limits; a larger income would keep more men free from the evil temptations of cheap, paying outside work and other functions ruinous to real scholarly production. But a second-class scholar would not produce first-class work with a steel trust salary. The chief point is not that the men who are inside the fence shall have a better time, but that better men shall go inside because they see what good times, what honors and premiums and laurels await them. And as in every profession the young men are always attracted by the few great premiums at the top, such an overuniversity might do much to gain the first-class men who to-day prefer too often law and business.

That is the point; we have not enough fine men at work and it is not true that the

trouble lies in our not discovering them. More than in any other country it is easy in America to discover the first-class man in scholarship if he is really on the ground and has not preferred to go over into banking or law or industry. The American university gives to every man the fullest chance, much more than in Germany, to show his powers, and yet the men are not found. I know one department in which last year three of our leading universities wanted to fill full professorships with first-class young men; two of the places are still unfilled because in spite of the most careful search the men could not be found; and from the most different departments in the country I get every year inquiries concerning German scholars, on account of the lack of really productive men in those special fields here. There is no need of new schemes to discover the extraordinary man; there is need only of schemes to keep him, in the midst of American surroundings, in the field of scholarship, and a new crown at the top of all our universities would be the strongest power. Scholarship would get a new standing in the land and it would be the logical development of the characteristic American factors. American scholarship has suffered enough from the necessary defects of its system; let us not ruin the strength of the system by patchwork interpositions which paralyze the peripheral energies and let us not have unused the tremendous powers of our system, which, through its principle of the sliding scale, allows at every point reached a noble development to a higher creation.

HUGO MÜNSTERBERG.
HARVARD UNIVERSITY.

AFTER the first feeling of happiness over the foundation of the Carnegie Institution, probably every one really interested was forced, consciously or unconsciously, to ask himself in what way this splendid en-

dowment could best accomplish its purpose.

In order to answer the query it seems necessary to take account of the present condition of education and research in our country. If it is taken for granted that the average intelligence and education of our people are fairly satisfactory, and the opportunities for advanced education abundant, there must be some good reason for the paucity of the researches of the highest order. That the country is inimical to the development of high intelligence is negative in the fields of statesmanship, invention and industry. The reason for the fewness of researches of high order I think is to be found in our governmental and educational institutions themselves. If one looks at the ideal of education in America, it will be found to be that the greatest number shall receive its benefits; and its success, from the smallest country school-house to the foremost university, is measured by the numbers which flock to receive its elementary and advanced instruction. Naturally and inevitably the teacher is overwhelmed by the administrative and teaching duties going with the large numbers of students and the small instructing staff. The few hours he can command on Sundays and in vacations must be used for renewing his strength to meet the every-day routine, or if he is blessed with abounding health and energy he feels that it is only the small investigations that can be undertaken with a hope of bringing them to a conclusion. The greater problems which are ever with him must wait till a hoped-for day when sufficient time, means and facilities are at his command; and these in most cases never come. In institutions not primarily educational the conditions are almost as discouraging. Holders of such positions must also attend to administrative work, and must produce

reports to show a reason for being, and immediate results are demanded.

Here then, as pointed out by the founder, is the field for the Carnegie Institution. By supplementing existing institutions and making it possible to free from excessive routine a few who know what ought to be done, and who know how to undertake and carry on researches of the high character contemplated, and who can begin and continue with enthusiasm researches that will require five years to a lifetime even, before results can hope to be obtained. And some also should receive encouragement who will undertake investigations where apparently only negative results will be gained; for often these results are negative only in appearance, and furnish the data by which the most positive results may not be missed.

I am aware that the feeling is quite strong that a considerable share of the income could be most advantageously used in establishing additional fellowships at existing institutions. This would not be wise, for the work done by the holders of such fellowships is, with rare exceptions, more in the nature of education than of research. The young people who fill these fellowships are just learning how to do advanced work, and are by no means prepared to undertake researches of a high character independently. The process of selection has not gone far enough to separate the able student from the one with a genius for research.

While additional fellowships are not advocated, the desirability of finding the exceptional young persons who shall ultimately become capable of assuming 'leadership in discovery' has not been lost sight of. It is believed that the plan proposed of dealing generously with those who have already proved themselves, would most safely and certainly accomplish the desired end. Naturally the older investiga-

tor with a specific problem to solve would select more rigidly than any committee of a faculty, where it is understood that the selection really means the giving of an opportunity to gain a little more education, get a taste of research perhaps, and prolong for a year or two the pleasure of collegiate life. If selected by the investigator for a definite piece of work in the furtherance of the large research, the young man would have opportunity to continue long enough at the work to find out whether or not he could become one of the leaders; and under the wise conservatism of the older man he would gain a safe but powerful momentum which could never be lost.

If, then, it is granted, following the conception of the founder, that the first aim of this institution is to foster research, the practical question for the administrators of the trust is to determine in what way this can be most satisfactorily accomplished.

From my own experience and observation, I think that one of the most important aids it can render is to make it possible for the scientific journals and proceedings of societies in our country, to publish in proper form and with adequate illustrations the scientific results which are actually being produced each year. If one compares the beautiful illustrations in foreign periodicals with most of those in our own, the contrast is certainly painful. How frequently does one see in a scientific journal, or hear through the editor, that illustrations costing over a given—usually very small—sum must be paid for by the author. That is, the author must in the beginning meet most of the cost of his research, and then pay for its adequate publication.

In the second place, as the fund is to supplement existing institutions, the persons selected to carry on researches would naturally work at those institutions where

the main part of the plant needed for the investigation is already available. When the person is once selected for a given research, he should be granted absolute liberty of procedure, be given abundant time and generous financial aid.

The specific problem in biology, giving promise of the largest results, it seems to me, is the working out to completion of the entire life cycle of a few forms, rather than the investigation of a detail of structure or of physiology in a great many forms.

It is believed that the thorough investigation of the structure and physiology of a few forms from the ovum to birth, from birth to maturity, and from maturity to old age and death, would most rapidly advance biologic knowledge, and furnish the basis for truly safe and great generalizations. As such research should form part of a solid and enduring structure, it would be of great advantage if the investigator would preserve a complete series—embryologic, histologic and anatomic—of the form whose life cycle was the subject of the research. This series should be deposited in some institution—naturally the one where the work was done—and be open for inspection by competent observers. Such a series would serve not only as a voucher for the validity of the published results, but also to correct errors of interpretation made evident by increased knowledge; and finally it would serve as a basis for further researches.

To briefly summarize: It seems to the writer that (1) The Carnegie Institution is not needed for educational purposes.

(2) Its true place is expressed in the first aim given by the founder—‘to promote original research.’

(3) It can most effectively promote research by utilizing as far as possible the facilities of existing institutions.

(4) Its support of the men selected to undertake researches should be generous, and abundant time should be allowed.

(5) The researches most demanded in biology at the present time are complete investigations of the embryology, structure and function of a few forms from the ovum to old age and death.

SIMON HENRY GAGE.
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THE fundamental principles which ought to control the Carnegie Institution can hardly be better stated than Dr. Cattell puts the matter in the last paragraph but one of his article. It should cooperate with, not interfere with, men and institutions already engaged in scientific work. And I take it that such is the intention both of Mr. Carnegie and of the trustees. The practical question of how this can be done is doubtless the chief problem that confronts the trustees at the outset.

It is my opinion that a *modus operandi* will be found in judicious attempts to meet specific cases. Good as Dr. Cattell's presentation of the whole matter is, nothing he says would appeal to me so forcibly, if I were a trustee, as what he says about work that could be advantageously undertaken in psychology and in the support of scientific publications. For the same reason I should expect from the active workers in every branch of science in the country suggestions regarding their own work and how it could be most effectively advanced. It goes without saying that many requests for help must be denied by the trustees. The perpetual-motion man is bound to turn up, and he will have to be turned down. But between the perpetual-motion enthusiast and the scientific man of established reputation there are many little known but competent workers whose requests for help should receive careful

consideration by committees of specialists.

Cooperation will mean different things, according to circumstances. Dr. Cattell's scheme of having the Institution appropriate five or ten thousand dollars for this and that bit of work, on condition that an equal sum be raised, reminds one of the estate that *might* have been bought with a pair of boots—if only the boots had been forthcoming. I want very much to undertake a certain piece of geologic work that would require about \$10,000, but if the Carnegie Institution offered to give \$5,000 for the work on condition that I raised the other \$5,000, I should get no help. And there are very few men engaged in university work who could meet such conditions; as a rule university professors are but little in touch with the business world that furnishes the money for investigations of this kind.

Dr. Cattell's suggestion regarding the teacher's sabbatical year seems worthy of attention. The sabbatical year is a great blessing to education and to science, but in many cases with which I am acquainted professors are unable to avail themselves of their leave of absence, because half of their salaries will not support their families and allow them to utilize their vacations in scientific work either at home or abroad. If the Institution could utilize these sabbatical years and pay the men enough to make up the deficiency in their salaries, it would effectively utilize this class of men and would at the same time carry out Dr. Cattell's second principle by improving the condition of men of science.

My suggestions would, therefore, be as follows:

I. The Institution should try to help wherever help is needed and can be advantageously used.

II. It should refrain from unnecessary or unwelcome interference in work already being done by individuals and by other institutions.

III. Care should be taken to encourage scientific work all over the country.

IV. Applications for aid should be received from men engaged in scientific work, and these applications should be referred to committees of specialists for advice.

V. The national government should co-operate with the Institution by providing the necessary buildings at Washington and by permitting, so far as convenient and under proper restrictions, the utilization of the scientific bureaus of the various departments.

VI. Some means should be sought to utilize the sabbatical years of university professors engaged in scientific work.

I have no doubt, however, but that the Institution contemplates doing all these things and many more.

J. C. BRANNER.

STANFORD UNIVERSITY, CALIF.,
September 15, 1902.

I HAVE read with great interest the proof-sheets of the article on the Carnegie Institution. I approve of most of the suggestions. The directors of the Institution must feel their way for a time, and relative values will be made clearer by experience.

The vital principles should be, as stated in the article:

(a) To work in harmony with existing institutions, not conflicting with them, and not relieving them from any present necessity of effort.

(b) To make the work of scientific investigators freer and more effective.

I should place first in present importance among the many possible lines of work that of helping men who have important

investigations or important compilations (as bibliographies) well begun to carry their efforts to a successful end. There are many cases of this kind, in which the worker needs not salary, but help, books, materials, and more often clerk-hire, artist-hire or means of final publication in proper form. Here the exceptional man is already at hand. He will do his work whether encouraged or not. He will bring it to a successful end, if he can have time, help and opportunity.

The establishment of laboratories at Washington for special investigations not yet well provided for seems to me most legitimate. One example of such an institution would be a breeding house or vivarium for the study of heredity and variation on a large scale and with a competent force for observation and record. Such an establishment should be in charge of the man who, whatever his nativity, could make the most out of it. In every branch of knowledge there is some real demand for help of this kind.

I trust that no part of the fund will be used to pay the expenses of students as such, as distinguished from tried investigators. The university fellowship, a fund for paying the board bills of those who may turn out to be scholars, is not gaining in esteem. Doubtless a Carnegie fellowship to one doctor in philosophy out of every ten would help scientific research somewhat, and it could be used—as few fellowships are now used—without danger of pauperizing embryo investigators. But so long as so many better uses for money exist, this one need not be considered.

I do not underrate the value of opportunity to the eager but impecunious student. The free use of a room in the old Smithsonian Tower was once the most valued 'fellowship' open to young naturalists in America. The present writer, among others, feels the sincerest gratitude for the

hospitable 'fellowship' thus extended to him at Washington by Professor Henry and Professor Baird. But its value lay in the acquaintance with scientific men and in the free access to specimens. The reduction of Washington board bills was a mere incident. One duty of the Carnegie Institution should be to make the scientific resources of the Capital available to those who can use them.

In this connection the word scientific should have the broadest definition. It should include historical, economic, literary and linguistic research, all that has a foundation in exact methods.

DAVID STARR JORDAN.

*THE IMPENDING CRISIS IN THE HISTORY
OF THE MARINE BIOLOGICAL
LABORATORY.*

THE action of the corporation of the Marine Biological Laboratory, at its recent meeting, August 12, leaves the fate of the laboratory to be decided by the trustees of the Carnegie Institution. It was not a welcome step to surrender the laboratory, but the financial situation seemed to offer no other solution. Some felt very strongly that further deliberation was much needed, but there was danger that delay would prejudice our case with the Carnegie trustees. Compulsory as were the circumstances, it is certain that the corporation and the trustees would have said no to the proposition to surrender, had they felt that our work and plans for the development of a biological center of a national character would thereby be hampered or curtailed. As the matter now stands, it only remains for the trustees of the Carnegie Institution to decide whether they will consummate the steps already taken towards acquiring the laboratory and making it a 'department' of the institution.

In spite of the assurances to the contrary which we have received through one or

two of our trustees, I think we may already see that the organization of the Carnegie Institution will necessarily limit our freedom of action and perhaps deprive us of the most essential thing in our independence, namely, *the power to decide upon the nature and scope of our work*. Had such a danger been seen even as a possibility, it is doubtful if the corporation could have been persuaded to transfer the ownership of the laboratory; and had it been seen as a probability, it is certain, I believe, that the vote to transfer would never have passed.

The vote was essentially a vote of confidence in our hoped-for supporters. Only our part of the situation was entirely definite. What the Carnegie Institution would develop as an organization was too largely a matter of conjecture to permit of clear vision. Some points had come out in personal conferences with members of the Carnegie executive committee, but these had not been definitely enough formulated to bring before the corporation. The visible portion of the situation was a debt of about \$10,000, doubled by the purchase of land just completed, and an offer of money-relief, contingent on a complete surrender of property rights. It was known, of course, that the transfer of property would make the laboratory a 'department' or 'branch' of the Carnegie Institution, centered at Washington. It was not realized that becoming a 'department' might in some fundamental respects endanger our control of the future development of the laboratory. In fact, we were told by some of those who had formulated the scheme of amalgamation that we should lose nothing essential to our independence, while we should gain a permanent support that was 'almost beyond the dream of avarice'! We were told that if we delayed decision, it would look like lack of confidence, and that we might thus lose